

## Claims:

1. An ultra sensitive in-situ magnetometer system, comprising:  
a deposition source;  
a cantilever paddle of the chip on which magnetic atoms incident from the  
5 deposition source are deposited;  
an interferometer for sensing vibration of the cantilever paddle of the chip  
to output an electrical signal;  
a deposition head for maintaining an appropriate distance between a  
cleaved fiber end of the interferometer and the surface of a cantilever paddle of  
10 the chip;  
a high voltage amplifier for amplifying the signal that is supplied to piezo  
material ; a piezoelectric material oscillated by the amplified voltage from the high  
voltage amplifier;  
a lock-in amplifier for detecting a signal from the piezoelectric material;  
15 a phase locked loop (PLL) for performing a phase locking operation  
between a signal output from the interferometer and the signal input to the  
piezoelectric material;  
a power amplifier for amplifying an alternating current (AC) voltage  
output from the lock-in amplifier and applying the amplified AC voltage to the  
20 torque coil inside the deposition head; and  
an oscillator for receiving an output voltage of the interferometer from the  
lock-in amplifier and monitoring displacement of the cantilever paddle.
2. The ultra sensitive in-situ magnetometer system of claim 1, wherein the  
signal generated from the PLL cancels out the vibration of the cantilever paddle.
- 25 3. The ultra sensitive in-situ magnetometer system of claim 1, wherein the  
interferometer that can adjust the laser wavelength to find the best fringe and  
visibility by controlling the temperature of a laser diode.
4. The ultra sensitive in-situ magnetometer system of claim 1, wherein the  
PLL comprises:  
30 a phase detector for generating a direct current (DC) voltage  
corresponding to a phase difference between the signal input from the laser  
interferometer and the signal output to the piezoelectric material;

a loop filter for filtering a signal output from the phase detector; and  
a voltage controlled oscillator (VCO) for receiving a signal output from  
the loop filter to convert the received signal into a sinusoidal signal with 180°  
phase inversion and output the converted signal and keeping the phase difference  
5 by feeding back the sinusoidal signal to the phase detector.

5. The ultra sensitive in-situ magnetometer system of claim 1, wherein the  
deposition head comprises:  
a deposition shield in which a deposition hole is formed;  
an insulation material installed on the deposition shield, the insulation  
10 material comprising a hollow body and a hollow protrusion formed on the body;  
an electric conductor(non-magnetic) coupled to the protrusion;  
a piezoelectric material installed on an upper part of the electric  
conductor;  
a first non-magnetic metal such as copper plate in which an upper  
15 electrode of the piezoelectric material is formed on one side of a lower end of the  
first non-magnetic metal plate, the first non-magnetic metal plate being installed  
on an upper part of the piezoelectric material;  
the cantilever chip installed on an upper part of the first non-magnetic  
metal plate;  
20 a photoresist stacked on an upper part of a frame of the cantilever ;  
a second non-magnetic metal or copper plate coupled to the optical fiber;  
a support plate vertically coupled to the deposition shield;  
a permanent magnet supported by the support plate; and  
a torque coil attached to the inner side of the deposition shield, and  
25 wherein the first and second non-magnetic or copper plates are coupled by  
screws.

6. The ultra sensitive in-situ magnetometer system of claim 5, wherein the  
insulation material is ceramic.

7. The ultra sensitive in-situ magnetometer system of claim 5, wherein the  
30 deposition shield protects the inner parts of the deposition head during the film  
deposition.

8. The ultra sensitive in-situ magnetometer system of claim 5, wherein the

support plate is an electrically conductive metal (non-magnetic) or ceramic.

9. The ultra sensitive in-situ magnetometer system of claim 5, wherein the insulation material is for insulation between the deposition shield and the lower electrode of the piezoelectric material.

5           10. The ultra sensitive in-situ magnetometer system of claim 5, wherein the non-magnetic electric conductor is configured by a material compatible with UV.

11. The ultra sensitive in-situ magnetometer system of claim 5, wherein the lower electrode applies voltage to the non-magnetic electric conductor.

10           12. The ultra sensitive in-situ magnetometer system of claim 5, wherein the piezoelectric material generates feedback vibration to cancel out the motion of the cantilever paddle.

13. The ultra sensitive in-situ magnetometer system of claim 5, further comprising a deposition hole plate being configured by Si, wherein a thin film is  
15 deposited only on the paddle except for the leg of the cantilever.

14. The ultra sensitive in-situ magnetometer system of claim 5, wherein the photoresist is spaced from the paddle of the cantilever and the cleaved fiber end by a predetermined distance.

15. The ultra sensitive in-situ magnetometer system of claim 1, wherein  
20 small and long grooves are formed so that the effect of Eddy current can be minimized during a film deposition.

16. An ultra sensitive in-situ magnetometer system, comprising:  
a deposition source;  
a cantilever chip in which a cleaved fiber end is faced on one side of a  
25 cantilever paddle of the chip and magnetic atoms incident from the deposition source are deposited on the other side of the cantilever paddle surface of the chip;  
a power amplifier for rectifying an external input voltage to vary an amplitude of the rectified voltage and the varied amplitude;

an interferometer for sensing vibration of the cantilever paddle to an electrical output signal;

5 a deposition head comprising the cantilever chip therein for maintaining an appropriate distance between an cleaved fiber end of the interferometer and a surface of the cantilever paddle;

a lock-in amplifier for sensing a signal output from the interferometer;

10 a phase locked loop (PLL) for sensing a signal output from the interferometer, performing a phase locking operation based on the signal from the interferometer and a signal input to the torque coil, and eliminating the frequency shift due to mass loading effect to the final magnetic signal during the film deposition;

a computer for storing an output signal of the interferometer from the lock-in amplifier;

15 the torque coil for generating an alternating current (AC) torque field by means of an AC voltage output from the power amplifier; and

an electromagnet for generating a bias field due to an applied external DC V.